IN THE CLAIMS

Please cancel Claim 13.

13. (Cancelled) The optical device of claim 2, wherein each optical circuit unit includes an electro-optical actuator.

REMARKS

Examination and allowance of pending Claims 1-36 are respectfully requested.

The Examiner rejected Claims 1, 15, 21, 22, 24, and 28 under 35 U.S.C. § 102(e) as being anticipated by Kuroyanagi et al (U.S. Patent 6,154,583), hereinafter Kuroyanagi.

Kuroyanagi does not describe nor suggest ... a first row of M optical circuit stages, each of the M optical circuit stages being connected to an adjacent optical circuit stage by N parallel waveguides *having substantially no curvature*; and a second row of M optical circuit stages, each of the M optical circuit stages being connected to an adjacent optical circuit stage by N parallel waveguides *having substantially no curvature*, wherein the first row is coupled to the second row to form a multi-stage planar device, and N and M are integers.... as described in Applicant's Claim 1. (emphasis added).

Kuroyanagi describes a three-stage switch circuit proximity coupler where optical amplifiers are arranged on the input and output sides of an optical space switch in a first stage. The optical space switch and the optical amplifiers on both the input and output sides are used as an expansion unit for expanding a switching capacity. However, Kuroyanagi does not describe or suggest... each of the M optical circuit stages being connected to an adjacent ... stage by N parallel waveguides *having substantially no curvature*... as recited in Applicant's Claim 1.

Applicant fails to see where the recited elements are specifically described in the Kuroyanagi reference. Applicant contends that nowhere in Kuroyanagi is there a description or suggestion of this novel element of ... "M optical circuit stages being connected to an adjacent ...stage by N parallel waveguides having substantially no curvature". Applicant notes that the Examiner did not identify where this specific element is taught in the alleged anticipating reference. While the Examiner points to Kuroyanagi's **FIG. 5**, reference numerals 1, 8, 57, and 64 as teaching Applicant's element, these numbers are not specifically referred to or defined in Kuroyanagi's specification. No mention of connections or waveguides having no curvature or substantially no curvature is made within the Kuroyanagi description. Further, Applicant argues that the Kuroyanagi description does not disclose or suggest a physical layout of its input and output port *connections*, for instance with regard to each of the optical switches in the first and third stages being used as expansion units and the 1x8 optical switches in the second stage being connected to these expansion units (Kuroyanagi col. 9, lines 1-16).

Applicant's invention optimizes wafer utilization by purposely avoiding large curvatures between rows on the substrate thereby increasing the number of devices produced per wafer, as indicated by parallel linear waveguides (reference 18 for one example) in Applicant's **FIG. 4**. Applicant contends that

one of ordinary skill in the art would find there to be a marked difference in the implementation of Applicant's claimed elements with that of the referenced prior art. Furthermore, Applicant feels that this element goes to the very essence of Applicant's invention and as such is not merely a minor aspect of the claimed invention warranting an inherency or common knowledge rationale of the prior art and hence allowing for the gap in the reference. Since the reference is silent as to the asserted characteristic, and no extrinsic evidence is presented clearly indicating that the missing descriptive matter is necessarily present in the reference and that it would be so recognized by persons of ordinary skill, Applicant concludes that the missing element would not necessarily result from the prior art reference. Applicant further concludes that, on the contrary, there must implicitly be a substantial amount of waveguide curvature between stages in Kuroyanagi in the three-stage circuit of their optical switch design as was common in the art at the time.

Accordingly, Applicant argues that each and every feature of the claim as arranged in the claim is not taught by the cited prior art reference and that hence a *prima facie* case of anticipation has not been made.

For that reason, the rejection is improper and Applicant's Claim 1 is patentably distinct over the Kuroyanagi reference under 35 U.S.C. § 102(e). Applicant's Claim 15, which depends from Claim 1, is also patentably distinct over the Kuroyanagi reference under 35 U.S.C. § 102(e) for reasons discussed above in conjunction with Claim 1. The Examiner states that independent method Claim 21 is also anticipated by Kuroyanagi. Applicant maintains similar arguments discussed above in conjunction with Claim 1 in that Kuroyanagi does not describe or suggest ... providing a planar device having a plurality of rows, each of the plurality of rows having M optical circuit stages, each of the M optical circuit stages being connected to an adjacent optical circuit stage by N parallel

waveguides having substantially no curvature, wherein N and M are integers, separating the planar device into a plurality of discrete components, wherein each discrete component includes a row of the plurality of rows; and coupling the plurality of discrete components to form a multi-stage planar device...as recited in Applicant's base Claim 21. (emphasis added).

Hence, it would not have been obvious to one of ordinary skill in the art at the time the invention was made to have, as Applicant recites in Claim 21 ... the M optical circuit stages being connected to an adjacent optical circuit stage by N parallel waveguides having substantially no curvature. Additionally, applying the rationale above, Applicant contends that Claims 22, 24, and 28, which depend from Claim 21, directly and indirectly respectively, are also not anticipated by the Kuroyanagi reference.

Accordingly, the rejection under 35 U.S.C. § 102(e) is improper and should be removed.

The Examiner rejected Applicant's Claims 2, 3, 14 and 23 under 35 U.S.C. § 103(a) as being unpatentable over Kuroyanagi in view of Madsen et al. (US Patent No. 6,253,000 B1), hereinafter Madsen.

Kuroyanagi does not describe or suggest, whether taken separately or together with Madsen ... wherein each of the M optical circuit stages includes N-optical circuit units to form an N x N multi-stage planar device... as recited in Applicant's dependent Claim 2. The Examiner submits that Kuroyanagi does not disclose the device wherein the optical circuit stages include N-optical circuit units. The Examiner states that the Madsen reference discloses a device wherein the M optical circuit stages includes N-optical circuit units. The Examiner states that it would be obvious to one of ordinary skill in the art at the time the

invention was made for the M optical circuits to include N-optical circuit units as one would be motivated to simplify the device by allowing the same optical switching device to be used at each stage.

Applicant argues that the same optical switching device would not be used at each stage in the resulting combination of references. Madsen's design assembles optical switching devices of unitary increasing dimension and the Kuroyanagi design effectively broadcasts from a smaller number in the first stage to a larger number of waveguides in the expansion stage.

Accordingly and for reasons discussed above in concert with Applicant's base Claim 1, Applicant's Claims 2, 3 and 14 are also patentably distinct over the cited art.

Applicant's Claim 23 which recites ...connecting the N output waveguides of a discrete component to the N input waveguides of an adjacent discrete component with optical fiber... is not described nor suggested by Kuroyanagi, whether taken together or separately from Madsen. The Examiner submits that Kuroyanagi does not disclose the use of optical fiber for coupling. Accordingly, and for reasons discussed above in connection with Claim 21, Applicant's Claim 23 is also patentably distinct over the cited references.

The Examiner rejected Applicant's Claims 4 and 5 under 35 U.S.C. § 103(a) as being unpatentable over Kuroyanagi in view of Madsen and further in view of Lagali et al (US Patent No. 6,292,597 B1), hereinafter Lagali.

Kuroyanagi neither describes nor suggests, whether taken together or separately from Madsen and/or Lagali, ... the switching device includes a Mach-Zehnder switch...as recited in Applicant's dependent Claim 4 nor ... the switching

device includes a Y-digital optical switch ... as recited in Applicant's dependent Claim 5. The Examiner submits that neither Kuroyanagi nor Madsen disclose the device where the switching device includes a Mach-Zehnder switching device or an Y-digital switch. In addition, Applicant's maintain the arguments above made in accord with base Claim 1, from which Claims 4 and 5 indirectly depend from, and accordingly assert that Claims 4 and 5 are also patentably distinct over the three cited references.

With respect to Applicant's rejected dependent Claim 6 rejected under 35 U.S.C. § 103(a) as being unpatentable over Kuroyanagi in view of Madsen and further in view of Plastow (US Patent No. 5,289,550), Applicant asserts that Kuroyanagi does not describe or suggest, taken together or separately from the Madsen and/or Plastow references, ... optical circuit unit includes a directional coupler... as recited in Claim 6. The Examiner submits that neither Kuroyanagi nor Madsen disclose such a coupler. Motivation to add a Plastow type coupler is not suggested by Kuroyanagi or Madsen. Accordingly and for reasons discussed above in harmony with base Claim 1 and Claim 2, dependent Claim 6 is also patentably distinct over the cited references.

The Examiner rejected Applicant's dependent Claims 7-13 under 35 U.S.C. § 103(a) as being unpatentable over Kuroyanagi in view of Madsen and further in view of Edwards et al. (US Patent No. 6,404,942 B1).

Applicant asserts that Kuroyanagi does not describe or suggest, taken together or separately from the Madsen and/or Edwards references, ... optical circuit unit includes a MEMS device... as recited in Applicant's Claim 7, ... optical circuit unit includes a thermo-optical actuator ... as recited in Applicant's Claim 8, ... optical circuit unit includes a mechanical actuator ... as recited in Applicant's Claim 9 ... optical circuit unit includes a electro-optical actuator ... as recited in

Applicant's Claim 10 ... optical circuit unit includes a electro-static actuator ... as recited in Applicant's Claim 11 ... optical circuit unit includes a magnetic actuator ... as recited in Applicant's Claim 12.

Applicant has cancelled Claim 13 without prejudice as it represented a duplicate of Applicant's Claim 10. The Examiner submits that neither Kuroyanagi nor Madsen disclose such MEMS devices or various actuators as recited in Applicant's Claims 7-12. Motivation to add an Edwards MEMS device or actuators is not suggested by Kuroyanagi or Madsen. Accordingly and for reasons discussed together with Applicant's base Claim 1 and dependent Claim 2, Applicant's dependent Claims 7-13 are also patentably distinct over the cited references.

The Examiner rejected Applicant's dependent Claims 16-17, 25-26 under 35 U.S.C. § 103(a) as being unpatentable over Kuroyanagi in view of Madsen and further in view of Douglass et al. (US Patent No. 5,786,979).

Applicant asserts that Kuroyanagi does not describe or suggest, taken together or separately from the Madsen and/or Douglass et al references, ... the chip-to-chip connection includes a laser weld... as recited in Applicant's Claim 16 ... chip-to-chip connection includes an adhesive ... as recited in Applicant's Claim 17, and similar method claim language recited in Applicant's Claims 24 and 25 respectively. The Examiner submits that neither Kuroyanagi nor Madsen disclose a chip-to-chip connection including laser weld or adhesive as found in Applicant's Claims 16, 17, 25, and 26. Douglass discloses an optical device connection having an adhesive however, motivation to add a Douglass type adhesive is not suggested by Kuroyanagi or Madsen and nowhere is it described or suggested to use laser weld. Accordingly and for reasons discussed above in association with base Claim 1 from which Claims 16 and 17 indirectly depend, and base Claim 21,

from which Claims 25 and 26 indirectly depend, Applicant's Claims 16, 17, 25, and 26 are patentably distinct over the cited references.

The Examiner rejected Applicant's dependent Claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Kuroyanagi in view of Madsen and further in view of Dannoux et al. (US Patent No. 5,447,585).

Applicant contends that Kuroyanagi does not describe or suggest, taken together or separately from the Madsen and/or Dannoux et al references, ... the chip-to-chip connection is implemented using a mass pigtailing technique... as recited in Applicant's Claim 18.

The Examiner submits that neither Kuroyanagi nor Madsen disclose a chip-to-chip connection implemented using a mass pigtailing technique as recited in Applicant's Claim 18. The Examiner states that Dannoux's abstract discloses such a mass pigtailing technique. However, Applicant claims that the motivation to add a Dannoux mass pigtailing technique is not described or suggested by Kuroyanagi or Madsen. Accordingly and for reasons discussed above in tandem with Applicant's base Claim 1 from which Claim 18 indirectly depends from, Applicant's Claim 18 is patentably distinct over the cited references.

The Examiner rejected Applicant's dependent Claims 19, 20 and 27 under 35 U.S.C. § 103(a) as being unpatentable over Kuroyanagi in view of Madsen and further in view of Graves (US Patent No. 6,366,716 B1).

Kuroyanagi does not describe nor suggest, whether taken together or separately from Madsen and/or Graves, ... the chip-to-chip connection includes aligning and mounting the first row and the second row on an alignment substrate...as recited in Applicant's Claim 19, which indirectly depends from base Claim 1, or ... index-matching material ... disposed between the first row and the

second row... as recited in Applicant's Claim 20, or ... the step of coupling includes disposing index-matching material between adjacent discrete components... as recited in Applicant's method Claim 27. The Examiner submits that neither Kuroyanagi nor Madsen describe or suggest the chip-to-chip connection includes aligning and mounting the first row and second row on an alignment substrate nor a device wherein an index-matching material is disposed between the first and second rows or adjacent discrete components. The Examiner cites Graves as disclosing the alignment substrate and an index-matching material disposed between optical components. Applicant argues that there is no motivation to combine these references and that furthermore Claims 19, 20, and 27 are patentably distinct for reasons discussed above in conjunction with Claims 1 and 21.

Accordingly, Applicant's Claims 19, 20 and 27 are patentable under 35 U.S.C. § 103(a) over the cited references.

The Examiner rejected Applicant's Claims 29-36 under 35 U.S.C. § 103(a) as being unpatentable over Kuroyanagi in view of Graves (US Patent No. 6,366,716 B1).

Kuroyanagi does not describe nor suggest, whether taken together or separately from Graves, ... providing a substrate and disposing a matrix of optical circuit stages on the substrate, each of the optical circuit stages being connected to an adjacent optical circuit stage by N parallel waveguides extending in a first direction to form at least one row of M optical circuit stages, *wherein the parallel waveguides have substantially no curvature*, and N and M are integers... as recited in Applicant's base Claim 29. The Examiner submits that the use of a substrate is not contemplated by the Kuroyanagi reference and that the Graves reference discloses a device wherein the optical matrix is disposed on an

alignment silicon substrate. Applicant argues that the motivation to provide a substrate for disposing a matrix of optical circuit stages is not present in Kuroyanagi and further that the recited ... the parallel waveguides have substantially no curvature...as recited in Claim 29 is not described or suggested in Kuroyanagi as articulated in the line of reasoning presented above along with Applicant's Claim 1.

Accordingly, Applicant's base Claim 29 and dependent Claims 30-36 are also patentably distinct under 35 U.S.C. § 103(a) over Kuroyanagi and Graves and the rejection should be removed.

CONCLUSION

Based upon the above amendments, remarks and papers of record, Applicant believes the pending claims of the above-captioned application are in allowable form and patentably distinct over the prior art of record. Applicant respectfully requests reconsideration of the pending claims and a prompt Notice of Allowance thereon.

Applicant believes that a **2 (two)-month** extension of time is necessary to make this Response timely. Should Applicant be in error, Applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. 1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Joanne Pappas at (781) 280-9031.

Respectfully submitted,

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Date: **March 4, 2003**

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CLAIMS

VERSIONS OF MARKINGS TO SHOW CHANGES MADE

1. (Unchanged) An optical device, comprising:

a first row of M optical circuit stages, each of the M optical circuit stages being connected to an adjacent optical circuit stage by N parallel waveguides having substantially no curvature; and

a second row of M optical circuit stages, each of the M optical circuit stages being connected to an adjacent optical circuit stage by N parallel waveguides having substantially no curvature, wherein the first row is coupled to the second row to form a multi-stage planar device, and N and M are integers.

2. (Unchanged) The optical device of claim 1, wherein each of the M optical circuit stages includes N-optical circuit units to form an N x N multi-stage planar device.

3. (Unchanged) The optical device of claim 2, wherein the optical circuit unit includes a switching device.

4. (Unchanged) The optical device of claim 3, wherein the switching device includes a Mach-Zehnder switch.

5. (Unchanged) The optical device of claim 3, wherein the switching device includes an Y-digital optical switch.

6. (Unchanged) The optical device of claim 2, wherein each optical circuit unit includes a directional coupler.

7. (Unchanged) The optical device of claim 2, wherein each optical circuit unit includes a MEMS device.

8. (Unchanged) The optical device of claim 2, wherein each optical circuit unit includes a thermo-optical actuator.

9. (Unchanged) The optical device of claim 2, wherein each optical circuit unit includes a mechanical actuator.

10. (Unchanged) The optical device of claim 2, wherein each optical circuit unit includes an electro-optical actuator.

11. (Unchanged) The optical device of claim 2, wherein each optical circuit unit includes an electrostatic actuator.

12. (Unchanged) The optical device of claim 2, wherein each optical circuit unit includes a magnetic actuator.

13. (Cancelled) The optical device of claim 2, wherein each optical circuit unit includes a electro-optical actuator.

14. (Unchanged) The optical device of claim 1, wherein the first row is connected to the second row by optical fibers.

15. (Unchanged) The optical device of claim 1, wherein the first row is connected to the second row by a chip-to-chip connection.

16. (Unchanged) The optical device of claim 15, wherein the chip-to-chip connection includes a laser weld.

17. (Unchanged) The optical device of claim 15, wherein the chip-to-chip connection includes an adhesive.

18. (Unchanged) The optical device of claim 15, wherein the chip-to-chip connection is implemented using a mass pigtailing technique.

19. (Unchanged) The optical device of claim 15, wherein the chip-to-chip connection includes aligning and mounting the first row and the second row on an alignment substrate.

20. (Unchanged) The optical device of claim 15, wherein index-matching material is disposed between the first row and the second row.

21. (Unchanged) A method for making an optical device comprising the steps of:

providing a planar device having a plurality of rows, each of the plurality of rows having M optical circuit stages, each of the M optical circuit stages being connected to an adjacent optical circuit stage by N parallel waveguides having substantially no curvature, wherein N and M are integers;

separating the planar device into a plurality of discrete components, wherein each discrete component includes a row of the plurality of rows; and

coupling the plurality of discrete components to form a multi-stage planar device.

22. (Unchanged) The method of claim 21, wherein the step of providing includes providing each component with N input waveguides and N output waveguides.

23. (Unchanged) The method of claim 22, wherein the step of coupling includes connecting the N output waveguides of a discrete component to the N input waveguides of an adjacent discrete component with optical fiber.

24. (Unchanged) The method of claim 22, wherein the step of coupling includes connecting the N output waveguides of a discrete component to the N input waveguides of an adjacent discrete component using a chip-to-chip connection.

25. (Unchanged) The method of claim 22, wherein the steps of coupling includes connecting the N output waveguides of a discrete components to the N input waveguides of an adjacent discrete component by laser welding.

26. (Unchanged) The method of claim 22, wherein the steps of coupling includes connecting the N output waveguides of a discrete component to the N input waveguides of an adjacent discrete component using an adhesive.

27. (Unchanged) The method of claim 22, wherein the step of coupling includes disposing index-matching material between adjacent discrete components.

28. (Unchanged) The method of claim 21, wherein the planar device is an N x N switch fabric.

29. (Unchanged) A method of fabricating an optical circuit fabric comprising the steps of:

providing a substrate; and

disposing a matrix of optical circuit stages on the substrate, each of the optical circuit stages being connected to an adjacent optical circuit stage by N parallel waveguides extending in a first direction to form at least one row of M optical circuit stages, wherein the parallel waveguides have substantially no curvature, and N and M are integers.

30. (Unchanged) The method of claim 29, further comprising the steps of:

separating the at least one row of M optical circuit stages into a plurality of optical circuit components; and

coupling the plurality of optical circuit components to form a multi-stage planar device.

31. (Unchanged) The method of claim 29, wherein the substrate is comprised of silicon.

32. (Unchanged) The method of claim 29, wherein the substrate is comprised of silica.

33. (Unchanged) The method of claim 29, wherein the waveguides are comprised of a silica material.

34. (Unchanged) The method of claim 29, wherein the waveguides are comprised of a polymer material.

35. (Unchanged) The method of claim 29, wherein the waveguides are comprised of a semiconductor material.

36. (Unchanged) The method of claim 29, wherein the substrate has an approximate surface area of 100mm x 100mm.